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ABSTRACT

Telematics for Teacher Training (T3), as a European support action, has prepared the profession of European teacher training for the infusion of Telematics into courses, plus the enhancement of training provision via telematics applications. T3 Consortium partners included eight teacher training institutions across eight European countries. Together they researched and developed the infusion of telematics applications into courses, such that good practice with Telematics was modelled in teacher training. Over 6000 teachers and others were trained over the three years of the project. Courses for primary and secondary teachers of science, languages, technology and mathematics are now established within institutional programs, as well as courses for teacher trainers and library staff. In addition, T3 has produced: (1) the T3 Centrum, an interlinked World Wide Web site, to improve access to courses, resources and research; (2) needs analyses for teacher trainers and librarians in the use of multi-media Telematics; (3) an exploitation plan that analyzes the worldwide market for telematics services in teacher training; and (4) research publications and dissemination activities that contribute to the preparation of the education profession's understanding of the information society. T3 has established innovative applications of Telematics in teaching and for good pedagogical practice through a network of user/researchers in universities across Europe. The incorporation of these research findings and the expertise of user/researchers into multidisciplinary research projects to benefit education and training are recommended for future programs. (Author)

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Telematics for Teacher Training Project

Final Report

Professor Niki Davis
& Dominic Prosser (Eds)

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Telematics Applications Programme for Education and Training

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Project Coordinator:
Professor Niki Davis

UNIVERSITY of EXETER

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THE TELEMATICS

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Author(s):	Professor Niki Davis & Dominic Prosser (Eds)
Contact Details:	telematics@exeter.ac.uk

Abstract:

T3, as a European support action, has prepared the profession of European teacher training for the infusion of Telematics into courses, plus the enhancement of training provision via telematics applications. T3 Consortium partners included eight teacher training institutions across eight European countries. Together they researched and developed the infusion of telematics applications into courses, such that good practice with Telematics was modelled in teacher training. Over 6000 teachers and others were trained over the three years of the project. Courses for primary and secondary teachers of science, languages, technology and mathematics are now established within institutional programmes, as well as courses for teacher trainers and library staff. In addition, T3 has produced:

- the T3 Centrum, an interlinked WWW site, to improve access to courses, resources and research
- needs analyses for teachers trainers and librarians in the use of multi-media Telematics
- an exploitation plan that analyses the complex worldwide market for telematics services in teacher training
- research publications and dissemination activities that contribute to the preparation of the education profession's understanding of the information society.

T3 has established innovative applications of Telematics in teaching and for good pedagogical practice through an expert network of user/researchers in universities across Europe. The incorporation of these research findings and the expertise of user/researchers into multidisciplinary research projects to benefit education and training is recommended for future programmes.

Keywords:	Telematics, teacher training, trainer training, librarian training, on-line training, pedagogy, courses, distance learning, WWW, e-mail, video conferencing, European, tele-learning, virtual university, professional development, organisational development

*Type: PU–public, LI–limited, X–internal
**Nature: PR–ProTotype, RE–Report, SP-Specification, TO–Tool, OT-Other

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Telematics for Teacher Training Project Final Report

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SU1117 T3 Executive Summary

Telematics for Teacher Training

What is T3?

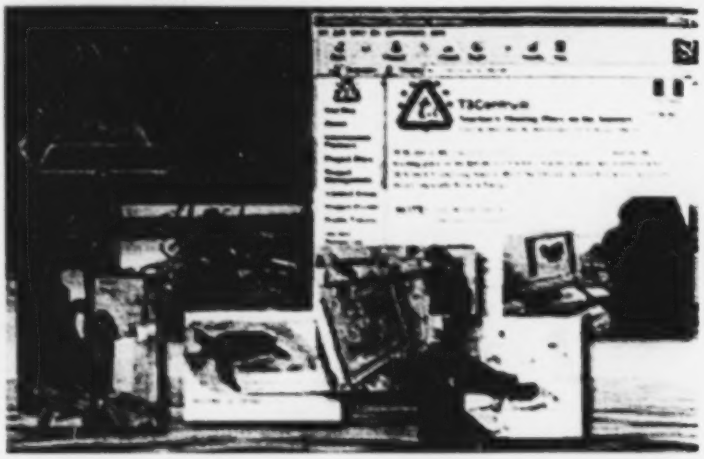
T3 is a European support action. It has prepared the profession of European teacher training for the infusion of Telematics into courses, plus the enhancement of training provision via telematics applications.

Setting the Scene

The information society depends on the infrastructure of education and training to ensure that European citizens are prepared to participate in the community and create wealth. Therefore, teachers' trainers, their trainers and librarians working with teachers are key agents of change. T3 has responded to this globally recognised need to update and improve teacher training and to diversify provision.

Approach

T3 Consortium partners included eight teacher training institutions across eight European countries. Together they researched and developed the infusion of telematics applications into courses, such that good practice with Telematics was modelled in teacher training. One partner took the lead in developing courses in each discipline or phase and then worked with other partners to transfer it to new contexts in Europe. All worked together on the research led by the evaluator and coordinator.



In summary, the objectives of the project were to:

- create and validate core courses for teachers, teacher trainers and library staff (over 200 staff to be trained)
- demonstrate and run courses for these staff in at least six European countries (over 4000 staff to be trained)
- provide a meeting place for teachers on the Internet, the T3Centrum
- produce relevant flexible learning materials for courses in both English and French (five packages)
- create a European Core Curriculum of Telematics for Teacher Training and ensure ongoing exploitation.

All the major stakeholders within European education, including new providers in commercial organisations, were involved through activities such as course development and validation, workshops, conferences and reviews of deliverables.

Results and Achievements

The project has distilled and modelled the best practice in distributed learning. This has taken place over the WWW and point-to-point video conferencing over ISDN2 for both primary and secondary teacher education and in the training of teacher trainers. All the major validation sites achieved ongoing 'services' or courses adopting Telematics within the training of teachers.

Over 6000 teachers and teacher trainers were trained through T3 activities. The design and delivery of courses for teachers of science, languages, mathematics, and technology for teacher educators and the library staff who support them have been incorporated into several institutional programmes. The evaluation and research activities have been widely published, thus validating the pedagogic approaches for institutional and professional development with and for Telematics.

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These achievements include:

- publication of curriculum materials and best practice with telematics applications
- demonstration of the courses in a wide range of validation sites, for both pre-service teacher education and the training of teachers in schools, across the seven countries
- creation and validation of the principles within an illustrated European Core Curriculum Framework of Telematics for Teacher Training
- an exploitation plan that analyses the complex worldwide market for telematics services in teacher training
- research publications and dissemination activities that contribute to the preparation of the education profession's understanding of the information society.

Conclusions and Plans for the Future

T3 has supported the teaching profession in preparing for the information society. It has done this by training teachers, establishing good practice with Telematics for teacher training and running ongoing courses within and across European countries.

The exploitation plan uncovered serious challenges to the provision of services to

teacher training, although a market has started to emerge in a few countries. Further routes for exploitation are recommended:

- through national initiatives
- by wider publication of the project's findings
- customisation of T3 courses and resources for different user requirements
- by informing Framework V research and development with the potential expertise to research the feasibility of a virtual teacher training college.

T3 has established innovative applications of Telematics in teaching and for good pedagogical practice through an expert network of user/researchers in universities across Europe. The incorporation of these research findings and the expertise of user/researchers into multidisciplinary research projects to benefit education and training is recommended for future programmes.

Contact Details

Project Name:

T3: Telematics for Teacher Training

Research Area:

Education and Training for teachers, teacher trainers and education librarians.

Timescale:

01.01.96 - 31.12.98

Budget:

Overall cost: >3.6M ECU
European Commission contribution: 2M ECU

Keywords:

Telematics, teacher training, trainer training, librarian training, on-line training, pedagogy, courses, distance learning, WWW, e-mail, video conferencing, European, tele-learning, virtual university, professional and organisational development.

Key Project Participants:

University of Exeter	(UK)
IUFM Grenoble	(F)
University of Oulu	(FI)
University of Utrecht	(NL)
University of Minho	(PT)
Dublin City University	(EI)
ICL	(UK)
ITD, Genoa	(IT)
University of Gent	(BE)

Project Coordinator:

Professor Niki Davis
Tel: +44 1392 264758
Fax: +44 1392 493761
E-mail:
telematics@exeter.ac.uk
Project URL: http://
telematics.ex.ac.uk/T3

1 setting the scene

The Challenge

The White Paper "Growth and competitiveness and employment: the challenges and ways forward into the 21st century" highlights the need to foster development of applications including distance education and tele-training. The Bangerman Report emphasised ten key application areas, one of which was the promotion of *'the extension of advanced distance learning techniques into schools and colleges.'* The Commission of the EU clearly recognises strategic benefits as shown in the DELTA programme, where reports have noted that Telematics can provide more efficient, more available education and training.

The central tenet of the European policy towards the information society is that European citizens will have the opportunity to become skilled and highly educated irrespective of location. European education is established for each individual in school under the guidance of the teacher. This project aimed to persuade the teaching profession, through their trainers, to adopt Telematics in order to enhance their own and their students' learning. Some suggest that school is the place where basic IT skills and knowledge should be. In this way, teachers can equip tomorrow's employees and customers with the competence to use new technologies and tele-training. Many students will also support others in the community in which they live.

Therefore, those who train teachers, their trainers and librarians working with teachers are recognised as key agents requiring training and who themselves will become agents of change. However, the take-up of Telematics in the education and training sector remains slow. Although teachers and teacher trainers can (and do) help themselves to the new knowledge and tools, the lack of training appropriate to their pedagogical needs, accompanied by demonstrations of good practice, have been significant deterrents. There is also a globally recognised need to update and improve teacher training and to diversify provision (Fullan, 1991, President's Committee of Advisors on Science and Technology & Panel on Educational Technology, 1997). T3 therefore aimed to speed innovation within and across training organisations, by the development of appropriate pedagogies and good practice, supported by a community of teacher training 'reference sites'.

What sort of TAP project was T3?

At the start of the T3 project in 1996, little was known of the needs of library staff across Europe. More was known about the needs of teachers and teacher trainers. A range of information and reports was available; much of this the product of earlier research by Consortium members.

In 1996, ISDN2 was the only affordable wider bandwidth for education. Multi-media Telematics was then a brand-new concept. The WWW was still emerging, and video had only just been added to whiteboard applications over ISDN2.

As a support action project, T3 was designed to focus on the training of users (teachers) rather than to support other TAP projects. T3 addressed the following specific tasks of the EC Framework Telematics Applications Work Programme:

SU 3.5 Demonstrations in regions	SU 5.3 Core courses in Telematics
SU 3.6 Dissemination of best practice	ET 3.3 Supporting user groups
SU 3.9 Sector-specific information networks	LB 3.2 Library-mediated intermediary services
SU 5.2 Training users	

The role of key participating organisations

The Consortium was led by people who were experts in two fields: education, and the development of new technologies for education and training (a summary table of the roles and responsibilities of the partner institutions is provided in Table 1). Prior to the start of the project, partners had already undertaken much of the needs analysis available for the teacher training user group in 1996 (see Somekh & Davis, 1997; Veen et al, 1994). Many Consortium members were already recognised as experts within networks of user associations and societies. Partners new to these human networks were added to enhance technological and distance learning expertise from northern Europe (Oulu), and a leading organisation in France transferred and adapted the project to the needs of new users. Commercial expertise was added by sponsors and small and medium-sized enterprise subcontractors, as well as some of the partners who had expertise in this area. At the start of the T3 project, the service providers, ICL (IT services) and BT (telecommunication services), were planning the first trials of the concept of a '*managed ICT service*' for educational organisations, including schools.

Project Partners	Roles
C1 University of Exeter (UK)	**Expertise in teacher training, Telematics and librarianship.** Project management and dissemination. Expert teacher trainers, researchers and librarians. Providers of teacher training at all levels and phases. **Leadership of courses for teacher trainers, librarians and mathematics teachers. Also exploitation (and, later, Core Curriculum).**
C2 IUFM Grenoble (FR)	**Expertise in the French language and cultural dimension.** Provider of teacher training for primary and secondary phases. Supporting FDL Primary, Language and Library courses.
C3 University of Oulu (FI)	**Expertise in distance learning in northern Europe and in technology education.** Provider of teacher training for primary and secondary phases. **Leadership of FDL and Technology courses.**
C4 University of Utrecht (NL)	**Expertise in critical evaluation of ICT in education and expert researchers.** Provider of teacher training for secondary phase. **Leadership of Language courses and project evaluation.**
C5 University of Minho (PT)	**Expertise in primary teacher training and children's studies.** Provider of teacher training for primary and secondary phases. **Leadership of Primary courses and early leadership of the Core Curriculum.**
C6 Dublin City University (EI)	Long-established ICT centre supporting schools; Links to GLOBE project; Masters programme for teachers. **Leadership of project WWW site (T3Centrum) and Science courses (01.01.96 - 30.06.97).**
C7 ICL (UK)	Expertise in commercial services. Superhighways trial of managed service with BT. Keen to investigate exploitation of educational market.
C8 ITD, Genoa (IT)	**Research expertise including science education via Telematics.** Keen to research transfer of telematics training. Supporting all course validation and implementation. **Leadership of Science courses (01.07.97 - 31.12.98).**
C9 University of Gent (BE)	**Expertise in design and cultural studies.** Links into network of language teachers across Europe. **Leadership of project WWW site (T3Centrum) (01.07.97 -31.12.98).**

Table 1: The roles and responsibilities of the nine full partners in the T3 project.

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2 approach

2.1 Project objectives and methodologies

The main aim of the T3 project was to support and develop the application of Telematics within different educational settings across Europe, in order to prepare the teaching profession for the information society. Indeed, the T3 partners have initiated processes of innovation by implementing the uses of Telematics within their institutions and beyond. The objectives included embedding Telematics within courses of teacher education for beginning teachers and for continuing professional development, including advanced courses for practising teachers, the teacher trainers themselves and librarians working in this context. As a support action project with a remit to target support directly at the end users, T3 established best practice using Telematics in a network of universities, schools and libraries that will continue to support the deployment of telematics networks.

The universities collaborated with a range of partners, including service providers and national government agencies. The objective of collecting together expertise across sectors and disciplines was used to develop policies, services and marketing strategies of value to education, especially teacher training. The telematics applications were selected for their affordability and accessibility to those in education: the Internet (WWW) and enhanced video conferencing over ISDN2. The aim was to ensure that teachers' skills in both telematics applications and in mentoring learners remain available even in remote rural areas with the use of modern technologies. The fundamental approach was to ensure that teachers could model their practice of lifelong learning for their students. In summary, the objectives of the project were to:
create and validate core courses for teachers, teacher trainers and library staff (over 200 trainees)
demonstrate and run courses for these staff in at least six European countries (over 4000 trainees)
provide a meeting place for teachers on the Internet, the T3Centrum
produce relevant flexible learning materials for courses in both English and French (five packages)
create a European Core Curriculum of Telematics for Teacher Training and ensure ongoing exploitation.

2.1.1 Methodology

Teacher training courses were developed in four discipline areas: mathematics, science, languages and technology. In addition, specific phases were addressed: primary school teaching, secondary school teaching, teacher training and library staff. One university in each of the eight European countries led the development of practice for each discipline. These first courses provided an approach for others to adapt and develop their models of best teaching practice with Telematics in the discipline. In this way, quality was assured and came to provide the teachers attending courses with an ongoing context for their use of Telematics in education. In addition, the courses have encouraged participants to engage in considerable action research and reflective practice, thus enhancing the quality of teaching and learning within and beyond teacher training.

Over three years starting in January 1996, a range of courses and resources were established for four disciplines: science, maths, languages and technology, and for teacher educators and librarians. A range of complementary activities designed to support course development and a community of practice included the development of an active core community, ongoing generation of curriculum materials and telematics best practice, plus the development of an associated network of World Wide Web servers (the T3Centrum). Courses were

'demonstrated' within and increasingly beyond their home institution and country. They were also validated by professional associations throughout Europe.

The projects' partners and user group included representation and participation by all the major stake-holders within education in Europe: teachers; student teachers; teacher trainers and researchers; ministries of education; training organisations; telecommunication companies and network operators; and software and hardware companies. At the start of the project, the partners agreed that an exploitation plan would aim first to establish courses within partner institutions' provision and then to look for wider opportunities.

2.2 Explanation of changes

It is recognised that change is required to improve teacher training. Others have expressed concern about the need to change and improve teacher education (or teacher preparation, as it is known as in North America) and that change is required at both an individual and an institutional level (see Fullan (1991)).

Education, technology and organisations all move at differing rates in response to national and international pressures. At the start of the project, Dublin City University (DCU C6), the Irish partner, was able to contribute expertise gained over many years of European collaboration and provision of professional development in information technologies to teachers. However, staff changes and the slower rate of development of Telematics in schools across Ireland caused DCU to change to the role of sponsoring partner. Extensive negotiations resulted in two actions. Firstly, the addition of a new partner, Royal University Gent (C9), to take on leadership of the T3Centrum on the WWW with additional support from Exeter. Secondly, the transfer of leadership of courses for Science teachers from DCU to ITD Genoa (C8), which led to the development and pilot of the EuMEDEA course across four countries and nine institutions beyond the T3 Consortium. These changes and related adjustments are also reflected in changes to the planned validation sites.

Adjustments were also made to the internal organisation at Grenoble (C2) which ensured better focus on language and cultural issues. Development of the internal structure of the University of Minho (C5) reduced its ability to lead the planned analysis of the Core Curriculum. Therefore, responsibility was divided between Minho and Exeter (C1), who took over the leadership. This redivision resulted in a highly successful workshop and colloquium in Minho and the refinement of the European Core Curriculum of Telematics for Teacher Training, which has been widely accepted and approved.

As planned, T3 hosted CAL97, the international education and training telematics conference, in March 1997 and it was very successful. However, it was agreed that the organisation of a second conference would have proved distracting in the final year. Therefore, the planned conference dissemination in 1998 was changed to participation in several conferences, including Teleteaching '98, rather than organising a single one.

The timing of the delivery of supporting resources and courses was adjusted in line with the needs of the European teacher training institutions and opportunities for exploitation. For example, the deadline for later FDL resources was extended in order to increase quality by drawing on more experience of good practice from T3 courses. Similarly, extensions in the final year of the project to the reports on courses for primary teachers and teacher trainers permitted the project to draw upon the expertise generated in subject-specific courses.

The development of technology and new approaches to the delivery of education and training through Telematics also affected the timing of the project. For example, the WWW was only just emerging at the start of the project and so it is not surprising to find that new approaches, such as the creation of an innovative language centre, took longer than anticipated. The differing styles of work highlighted issues of change management: top down or bottom up?

Similarly, the course for teacher trainers incorporated the innovative design of a Virtual Study Centre to match new approaches to pedagogy and so ensure more effective teaching and learning on-line. This was addressed in response to research findings which indicated that teachers were having to spend too much time in on-line teaching. The new pedagogic approach modelled by Oulu, in their course for technology teachers using the ProTo environment, was also influential.

The exploration of a European Service of Telematics for Teacher Training proved extremely challenging within the changing context of European education and training, as described in the Exploitation Plan (D16.1). Partners and sponsors found it difficult both to express and to share commercially valuable information in the early phases. In the last year of the project, 1998, it became clear that, at last, a segmented market was emerging. This then required a survey which, while it delayed the mature report, made it much more valuable.

2.3 Evaluation, validation and peer reviews

2.3.1 Evaluation

The continued re-evaluation of project plans spanned the lifetime of the project, ensuring that appropriate adjustments such as the one described above in Section 2.2 were undertaken where appropriate. This was both a formative and a summative evaluation. The formative evaluation focused on the development and implementation of emerging practices within the partner universities. The summative evaluation focused on the outcomes and impact of the project as a whole, and the development of pedagogical approaches for telematic learning environments. The main purposes of the evaluation (described in detail in D3.1 and D3.3) were identified as follows:

to support partners to improve performance by mutual understanding of applications of Telematics

to identify generic uses of Telematics in teacher training across Europe

to assist implementation within institutions and among partners with a focus on strategies and experiences of implementation

to support dissemination of results beyond the project partners

to contribute to the overall learning process for future projects and programmes.

The T3 project was built on a complex structure, which included a variety of cultural and educational settings. In addition, the objectives of the project could not be clearly defined and planned in advance. Therefore, a "multi-perspective illumination approach" (Melton & Zimmer, 1987; Parlett & Dearden, 1987) was used to evaluate the T3 project. This type of approach focuses on a specific issue as a whole in its natural context and attempts to illuminate it from a variety of perspectives. In the case of the T3 project, the issue was defined as the uses of Telematics in teacher education, including a large sample of input. For the evaluation of these innovation processes, a case study approach was adopted (Miles & Huberman, 1984; Yin, 1989). This approach included a variety of instruments for systematic and structured data collection to "create a case study database maintaining a chain of evidence" (Yin, 1989). The variety of tools that were used for the evaluation and the reporting included questionnaires, video conference and phone interviews, logbooks, documents, virtual and face-to-face workshops.

T3 has significantly contributed to the knowledge of the pedagogy of tele-learning and tele-teaching by reporting on partners' experiences and by providing evidence on factors and conditions of delivery and on the development of telematic learning environments evolved during the project. At the video conferences, the evaluation team played the role of 'broker', connecting the partners' activities, bringing them in contact with each other to collaborate on activities and increasing awareness of the project coordinator's views and concerns.

Overall, the end users were satisfied with the on-line courses and materials. The international collaboration that they experienced with other participants was viewed as important, useful and motivating. Many of the end users also recognised their T3 experience of learning and the experimentation with new technologies in education as one of the most important outcomes.

Stellan Ranebo, a peer reviewer of D3.3, gave his expert view informed by his experience with the Nordic Council of Ministers and as coordinator of the Nordic network for schools (which is now linked within the European SchoolNet (EUN) project). He endorsed the value of T3 by saying: "The (evaluation) report shows that the T3 Project has contributed a lot to the understanding of educational uses of Telematics in Teacher Training."

2.3.2 Validation activities

The approach to the validation of T3 courses was characterised by systematic collection, analysis and interpretation of data on the functions, organisation and quality of a course or educational programme within and across European educational institutions. The data (both qualitative and quantitative) was divided into three evaluation objectives; pedagogical functionality, cultural acceptability and communication, and technical design and reliability.

The validation process was implemented through two trial phases: first, the course was run locally in the originating institution, and then it was run internationally with users from both T3 and non-T3 institutions. Figure 1 illustrates how this process.

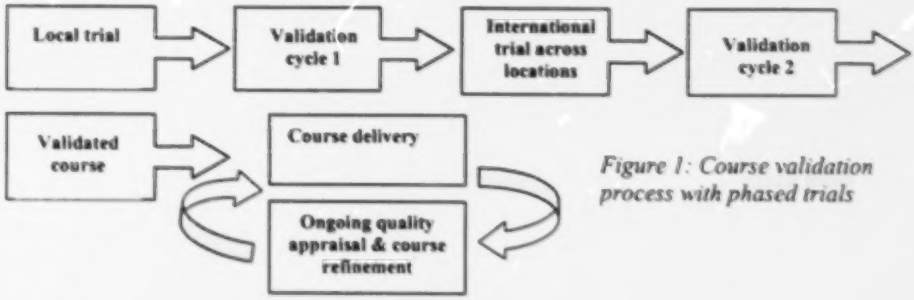

Figure 1: Course validation process with phased trials

Data was acquired from many sources during this validation process, in order to triangulate and so increase its validity, as shown in Figure 2. The analysis was used to refine the mature course, the design of telematic learning environments and for T3 know-how as expressed

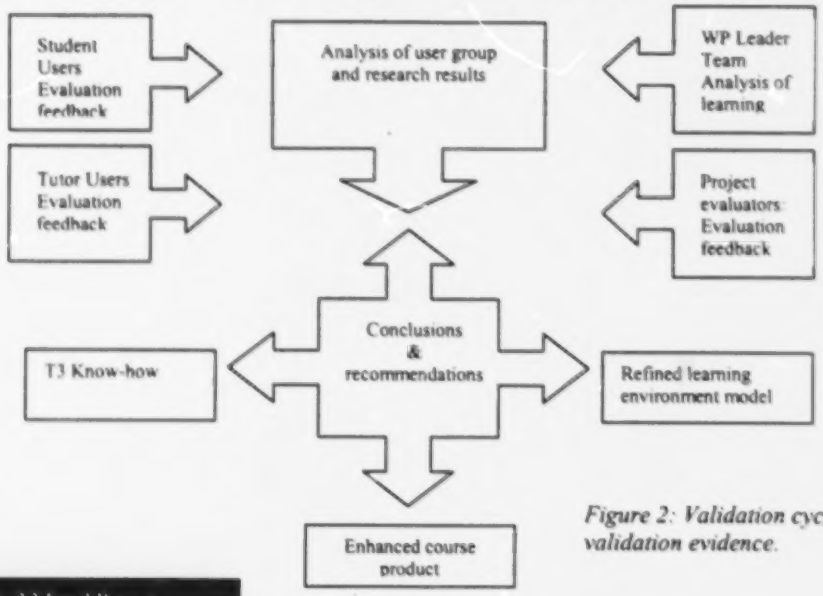
Student Users Evaluation feedback
Analysis of user group and research results
WP Leader Team Analysis of learning
Tutor Users Evaluation feedback
Project evaluators Evaluation feedback
Conclusions & recommendations
T3 Know-how
Refined learning environment model
Enhanced course product

Figure 2: Validation cycle: applications for validation evidence.

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through consultation and publications. Data collected by course developers and tutors was extended with additional materials selected by the evaluation team. For example, data was gathered from the students by questionnaires and from the tutors and teachers by asking them to write down their experiences and provide feedback on the course, and by analysing the essays and discussions in the on-line learning environments. The results of the validation activities are an integral part of Section 3's results and a major achievement of the T3 Project.

Validation sites

The major validation sites were the eight participating teacher training institutions, as planned. These brought in a range of schools that collaborated in the provision of initial teacher training as part of the management of change to integrate Telematics within teacher training. In addition, specific additional universities, colleges and schools became involved in teacher training and curriculum and resource development activities under the auspices of the T3 project. Table 3 provides an overview of these validation sites as they developed:

Country	*Institution*	*Courses*
Central and Eastern Europe	STACCIS project MATEN project	Resources only Approach only
Finland	**University of Oulu** 5 Haapavesi Primary Schools + many in-service teachers	All according to demand, especially technology
France	**IUFM Grenoble** 100 schools in the 'Réseaux Buissoniers',	All according to demand, especially language
Germany	University Library Universitaet Erlangen-Nuernberg	Library
Ireland	**Dublin City University** GLOBE project schools	Variety of pedagogical-focused courses
Italy	**ITD Genoa** Faculty of Science and Technology, Genoa; I.T.C. "Einaudi" Gorizia; 19 schools in Rome, Bologna, Florence, Genoa, Messina , Padua, and Venice	Many, especially science Technology and languages
The Netherlands	**Utrecht University** Graduate School of Teaching and Learning, University of Amsterdam; Hogeschool (HvU), Utrecht; Eindhoven University of Technology & Hogeschool; Public Observatory Simon Stevin, Eindhoven; Sint Gregorius College, Utrecht; University of Professional Education, Rotterdam; VSNU (Association of Universities in the Netherlands); Wageningen Agricultural University; Eindhoven, Delft & Twente Universities of Technology.	All except primary, especially language
Portugal	**Minho University** > 40 in-service teachers, Castelo Branco University	All except ibrarians, especially primary. Science
UK	**Exeter University** The Open University; Universities of Reading and Sheffield; Birmingham City Council;.11 Bristol schools in the BEON network; 298 University of Exeter Partner Schools; Jersey High School for Girls; Haywards Primary School and Redhills Primary School in Devon; LISE (Librarians in Institutes and Schools of Education) & Centre for Educational Research in Library and Information Management, Manchester Metropolitan University; The UK Library Association.	All, including courses for teacher trainers

Table 3: Overview of validation sites.

2.3.3 Peer reviews

Peer reviews were conducted on all the deliverables of the project, and led to appropriate restructuring of the final deliverable as required. The peer review procedure generally consisted of two phases; the first phase starting with an internal review by T3 partners. A second round of external review followed, leading to adaptation of the related course materials and/or documents. Key deliverables, such as the Exploitation Plan, were reviewed by a larger number and wider range of reviewers.

Peer reviewers were selected for their expertise in the field of educational Telematics or their experience as a relevant user of the specific workpackage, e.g. as a science teacher. Both internal and external reviewers provided very constructive criticism and acknowledged the value of the deliverables they reviewed for the development of telematics applications across Europe and the education profession.

The peer reviews covered a variety of issues, reflecting the background of the different reviewers, who were mainly teacher educators and other educational specialists from private companies or public authorities. In general, all reviewers commented on readability, structure and clarity of materials and documents and addressed the following specific points:
content of the materials produced, in particular their relevance and wider benefits for the end users across Europe
the usability of the on-line courses or documents for practising teachers and teacher trainers
their contribution to the development of a community of practice
the pedagogical models underlying the on-line courses
the relation to the aims and goals of the T3 project in general.

The comments of all T3 peer reviewers and other feedback have been analysed and, as T3 is a support action, these findings, recommendations and their dissemination are reported in the next section under results and achievements.

2.4 Collaboration at a European level

In common with many other international projects, the T3 Consortium has found immense added value in international, European-wide collaboration. Benefits of collaboration identified by T3 partners include:

- the establishment of a professional community of practice with the bonding of a strong project team of international experts who share the creation of a European knowledge Consortium or 'knowledge pool'
- the T3 partners have forged a network of change agents. Their 'peer pressure' through comparison of EU practice will more rapidly bring change in our own institutions, which will in turn grow within and beyond to other institutions and countries, to establish more appropriate and flexible curricula
- students and teachers who have participated in T3 are themselves now much more European in outlook and more willing to study through Telematics and to study abroad
- the transfer of the T3 learning culture has included the enculturation of flexible and distributed learning.

The participants are much more aware of the challenges of European collaboration and teaching though Telematics and requirements for an appropriate level of linguistic skill to follow the pedagogy. They understand the frustrations caused by inflexible differences in educational culture, especially national and regional curricula and conflicting institutional schedules.

Education operates within traditionally closed systems which are not readily able or willing to change. T3 uncovered principles for the management of change within and across European

institutions, in particular how institutional structure and culture must adapt to OFDL. It has been observed that even when change is possible, it appears to come very slowly.

Our colleagues in France, whose role was to help T3 address the plurality of European language and culture reflect. this in their comments in the Evaluation Report.

> “Face-to-face meetings with T3 partners were extremely productive and enabled us to work collaboratively: creating courses, trialling them and sharing good practice and pedagogical reflections with European colleagues. Our progressive integration in the team went from a local use of telematic tools (each of us working to produce his/her deliverables) to a wider approach (the partners working together to develop joint resources), demonstrating the feasibility of collaborative networking.
>
> The T3 project was also a very good incentive to go further in our research work: writing articles, reading about the integration of ICT in teacher training, especially about education in a networked society, looking at hypermedia, participating in congresses and widening our vision so that it became European in dimension.”

Hélène Godinet & Andrée Klein, T3 Grenoble

3 results & achievements

3.1 Accomplishments

The project achieved its aim to accelerate the rate at which teachers and teacher trainers are adopting Telematics across Europe. This is justified through the numbers trained, courses established and resources produced. It has also provided a substantial boost to pedagogical and technical design. In addition, the Consortium has become a source of collective knowledge and practice for those seeking to plan policy and practice in this key area. Advice and guidance have been provided to many European and other countries in a variety of ways, including the application of Telematics to provide consultation.

Over three years, the T3 Project trained and supported over 6000 EU teachers and related staff in the use of Telematics in education. It achieved its initial goals of delivering on-line courses within and between partner countries. In addition, a variety of products, such as resources on CD-ROM, policy documents, market research reports and conference papers have been published along with presentations and workshops held on several occasions. Together these have trained users, established ongoing demonstrations in a variety of European regions (SU3.5) and provided wider dissemination of good practice (SU 3.6). The training and support provided to the target educational user groups (SU 5.2, ET 3.3) have also resulted in the establishment of sector-specific networks for teacher training and library staff working with them (SU 3.9, LB 3.2). Core courses in Telematics are now informed by a European Curriculum of Telematics for Teacher Training (SU 5.3) as reported in D15.2 *Core Curriculum of Telematics for Teacher Training.* T3 has achieved all of its objectives and exceeded many of them too. In addition, the T3 Consortium partners contributed significant research relevant to TAP tasks. For example, T3 has published significant work of value to ET 1.9 '*Educational multi-media for the training of teachers and trainers*', including information about how to "establish and validate a network to continuously enrich the knowledge about technology-based learning."

A significant contribution can be attributed to T3 in achieving its goal of preparing the teaching profession for the information society. T3 has developed Telematics in courses for teachers of mathematics, science, languages and technology. Several countries, including Ireland and Sweden, are adjusting their goals to incorporate discipline-specific pedagogy and good practice with Telematics. T3 has prepared the way for this infusion of Telematics into phase and discipline-specific pedagogy. T3 has also established accredited postgraduate courses for teacher trainers and library staff working with teachers across Europe.

3.2 Courses and resources created

An overview of the courses and resources developed by partners is provided in Figure 4. It also provides an overview of the numbers of teachers and other staff trained according to country and to the focus of the courses. This matrix also forms the site map for the final version of the project WWW site, the T3Centrum. Behind this map the T3Centrum contains in excess of 5000 files, containing over 250MB of information and resources located across seven WWW servers in seven European countries.

The end results of T3 have achieved the objectives set for the project. Figure 5 shows the numbers trained from 1996 to 1998 according to trainee type: teachers, student teachers, teacher trainers and library staff. This exceeds the total specified by over 2000.

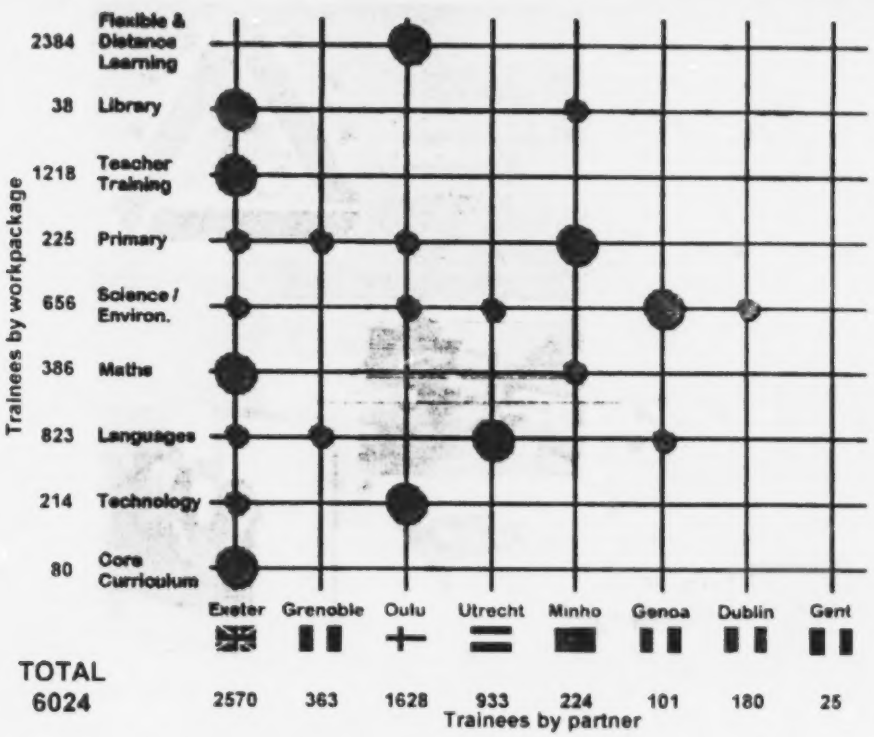

Figure 4: Overview of Courses and Resources, displayed as a matrix.

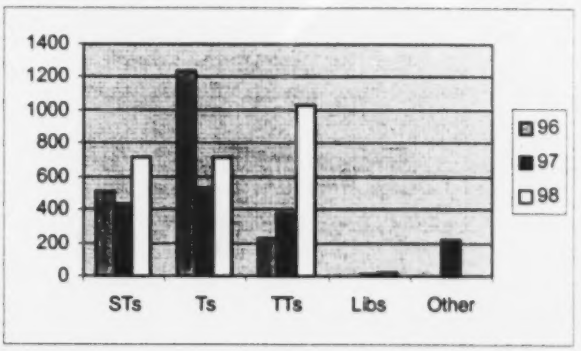

Figure 5: Numbers trained of Student Teachers (STs), Teachers (Ts), Teacher trainers (TTs), Librarains (Libs) and others by the T3 project over the years 1996, 1997 and 1998.

Other targets achieved include the publication of needs analyses for multi-media Telematics in teacher training and for the needs of librarians (see D6.1 *Paper for Academic Journal on the Needs Analysis* and D8.1 *Preliminary Report on User Needs Analysis*). These have been validated and have informed the educational community and the production of courses (see D8.2 *Report on Courses for library staff*). The agreement and validation of a European Core Curriculum of Telematics for Teacher Training has provided an important foundation for continued development and support (see Davis & Tearle, 1998). Similarly, courses are underpinned by the development of expertise within the teacher training profession, which will enable them to be updated in line with changes in technology and national curriculum standards.

The T3 showcase within the T3Centrum at http://telematics.ex.ac.uk/T3/ provides a comprehensive overview of a representative range of key products and services produced by T3. A summary of the 14 courses that are now available for European teacher training is provided in Table 4. The services and products encompass the following categories: **Courses** in the subject disciplines covered by the project, such as '*Control Technology*' for

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teachers of technology and longer modules for teacher trainers at Masters level such as '*Teaching Effectively with ICT*'. (See D13.1 *Report on the Course for Technology Teachers*, D7.1 *Report on Courses for Teacher Trainers*, D10.1 *Report on First Science Course*, D11.1 *Report on Language Courses* and D12.1 *Report on Courses for Mathematics Teachers*).

Flexible learning materials on the WWW and paper, such as '*Introduction to Telematics in Teacher Training*' in English and French. The material was subsequently translated into Finnish. (See D5.1/2/3/4 *Telematics in Teacher Training: Getting Started with Telematics* and D5.5 *Introduction à l'Utilisation de la Télématique dans la Formation des Enseignants*)

Extensive WWW sites: discipline-specific examples of excellent WWW design for education, such as '*EuroTurtle*', which focuses on environmental education through curriculum and scientific information on turtles, especially those in the Mediterranean (see Baggott & Poland, 1997); CEDIC in Portugal on children's matters; and the whole linked *T3Centrum* collection of WWW sites across the partner countries.

Services delivered through video conference and wider band technologies, such as '*Artist in non-residence*'.

Extensive reports, including the key T3 Final Evaluation Report (D3.3) and publications relating to research and evaluation of T3 products, services and the contexts for their delivery, including pedagogy and the Exploitation Plan which provides one of the first analyses of the market for teacher training in Europe.

A European Core Curriculum of Telematics for Teacher Training (D15.2) which, in its multi-media format on the WWW, links the principles to examples of good practice. This aims to establish principles for ICT training throughout the world.

Focus	*Course title*	Telematics Platform	Originating country
1. Language teachers	*Integrating ICT in learning and teaching language*	WWW, F2F and video conference	NL (with FR, IT and UK)
2. Language teachers	*Seminar: Integrating ICT in reading and writing*	WWW and F2F	FR
3. Librarians	*Telematics for Librarians* •	WWW	UK
4. Mathematics Teachers	*From Novice to expert mathematics teacher*	WWW and F2F	UK
5. Mathematics Teachers	*Master class with graphical calculators*	F2F/ video conference with WWW support	UK
6. Mathematics Teachers	*Statistics Courses*	WWW	UK
7. Primary teachers	*Telematics for primary teachers*	F2F, WWW resources	PT
8. Science teachers	*EUMedea: teaching environmental science though project work*	WWW and First Class, 1 video conference	IT
9. Technology Teachers:	*Control Technology (Lego/Logo)*	WWW (ProTo) and video conference	FI
10. Teacher Trainers	*Teaching Effectively with ICT* •	WWW (VSC)	UK
11. Teacher Trainers	*Learning Effectively with ICT* •	WWW (VSC)	UK
12. Teacher Trainers	*Managing & organising ICT effectively* •	WWW (VSC)	UK
13. Teacher Trainers	*Educational Technology Specialising Course* •	WWW (ProTo)	FI
14. Teacher Trainers	*ICT in Learning Environments*	WWW (ProTo)	FI
15. Teachers of art and culture	*Artist in non-residence service*	Video conference	UK

Key:

- •Accreditation available from the host institution, up to Masters level.
- F2F = face to face.
- ProTo is a WWW learning space developed by the University of Oulu and validated across Europe during T3.
- VSC is a WWW learning environment to encourage peer tutoring developed by the University of Exeter Telematics Centre during the T3 project.

Table 4: Courses available for European teacher training arising from the T3 project.

Focus	Resource title	WWW Address	Originator
All	*T3Centrum interlinked WWW sites*	http://telematics.ex.ac.uk/T3	7 countries
All	*T3 Showcase of courses and resources*	http://telematics.ex.ac.uk/T3	UK & BE
All	*T3 Core Curriculum of Telematics for Teacher Training*	http://telematics.ex.ac.uk/T3/CC	All
All	*Flexible and Distance Learning Materials for Telematics in teacher training: 4 Volumes (plus one French translation)*	http://edtech.oulu.fi/T3/WP05	FI (FR)
All	*ICT Educational Research Centre* •	http://telematics.ex.ac.uk/ERC/	UK
Language	*Language Centre*	http://tlo.ivlos.uu.nl/t3/lc/index.htm	NL
Language	*Les usages du web en situation pédagogique*	http://www.grenoble.iufm.fr/T3/Java/Didafin4/default.htm	FR
Language	*Cours sur les réseaux*	http://www.grnoble.iufm.fr/T3/Trait-text/index-en.html	FR
Maths	*From Novice to Expert*	http://www.ex.ac.uk/telematics/T3/maths/maths.htm	UK
Maths	*Teaching with graphical calculators*	http://www.ex.ac.uk/telematics/T3/maths/gchmpag.htm	UK
Maths (Statistics)	*Making Statistics Work for you*•+	http://telematics.ex.ac.uk/T3	UK
Primary	*CEDIC – Centre of Documentation & Information on the Child*	http://www.iec.uminho.pt/cedic	UK
Primary	*Totem Pole Project*	http://telematics.ex.ac.uk/totempole/	UK
Science	*EuMEDEA*	http://paradiso.itd.ge.cnr.it/english/projects/t3/eumedea/	IT
Science	*EuroTurtle* • *(including sections in Italian)* *(EuroTurtle guide in Dutch)*	http://www.ex.ac.uk/telematics/Euroturtle/ http://tlo.ivlos.uu.nl/t3/euroturt/index.htm	UK
Science	*Butterfly Sight with data and curriculum materials used across Europe*•	http://telematics.ex.ac.uk/butterfly/	UK
Science	*Biodiversity of man-made ponds*	http://telematics.ex.ac.uk/pondex/	UK
Technology	Nodding Toys Design Project	http://www.ex.ac.uk/telematics/T3/technology/nodding/nodhome.htm	UK
Technology	Totem Pole Project	http://telematics.ex.ac.uk/totempole/t3-project/tot-frame.html	UK

Note: • are resources owing to support from both T3 and other projects/sources.
+ follow route through the Showcase to mathematics, then statistics for demonstration.. Partner agreements with non-T3 partners preclude access to non-fee paying users.

Table 5: Resources created and developed through the T3 project for European teacher training.

A small sample of typical user opinion is provided below for this Final Report. Detailed information on users' views can be found in the report of the courses and the Evaluation Report (D3.3):

- From Teacher Trainers, the positive aspect that was mentioned most frequently was "the opportunity for group discussion/peer work". Other comments were "stimulating thought and reflection", "seeing new opportunities and techniques" and "meeting interesting people".
- On the whole, the language teachers were quite pleased with their course. All the respondents agreed that it would be "good to integrate this course in the regular study programme".
- Seventy-five percent of the teachers responding to questionnaires on the technology course stated that the course had a positive effect on their learning, and 50% indicated

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that they were satisfied with what they had learnt from this trial course. Students appreciated the opportunity to learn to use different telematics applications, the (international) collaboration with other countries, and the flexibility/independence in time and workspace.

Table 5 provides an overview of the resulting resources that are now available to European teacher training. They include a T3 Showcase that provides a guided tour through selected courses and resources, as well as the chance to sample activities or to move to the full location where it is open to users. There is also a facility to apply for courses on-line. This innovative design is one solution to the overload of information facing teachers who search for resources and training on the Internet.

3.3 Networks and expertise

The T3 project has stimulated the development of a network of researchers and a community of practice, consisting of teacher trainers involved in a variety of courses and other activities (Briano et al, 1998). Wider networks have also been involved. T3 has networked with the two other TAP projects focusing on teacher training: TRENDS and REM. T3 has also worked with the wider international networks formed by associations: the Association for Teacher Education in Europe (ATEE), the Society of Information Technology and Teacher Education (SITE), and the UK Association for IT in Teacher Education (ITTE). Research networks have included the International Federation of Information Processing's (IFIP) education working groups for research and for distance learning, the European Association for Learning and Instruction, and the British Educational Research Association.

The T3 project has provided considerable professional development for teacher trainers, course designers, webmasters and researchers. The collaborators have become international experts in educational Telematics, aware of critical factors influencing the implementation of Telematics in education, such as philosophy of education, openness and flexibility of curricula and the crucial issues of language and culture (see Lockhorst & Lam, 1998). The project has also stimulated institutional development at the majority of the partner universities, where the curricula for teacher training have been redesigned and new initiatives taken to further on-line teacher training within the national contexts.

The T3 evaluators summarised the main recommendations and findings of the T3 peer reviewers as follows:

- Within the T3 on-line courses, the project partners have been able to cope with dissimilarities in learning and teaching cultures in Europe; they have been a collaborative community of teacher trainers. However, these dissimilarities are a serious obstacle for on-line European-wide courses that will be delivered without a network of collaborating professionals.
- Large-scale delivery of on-line courses demands highly professional and technically reliable learning environments, providing intuitive communication facilities for inexperienced educational users. Such environments are still to come as many existing ones are based on an old educational paradigm.
- The delivery of open and flexible learning materials often relies on constructivist views and concepts. As far as the T3 on-line courses are concerned, it may be concluded that the collaboration between the partners has stimulated a shared pedagogical view. However, these views on learning and teaching conflict with existing teaching practice in many teacher training institutions and schools, where old rigid models are still in place.
- The integration of on-line learning into students' study programmes and teachers' working plans is a major issue to be addressed in future actions on the virtual professional

development of teachers.

- It has been noticed that strong technical support of teachers in schools is compulsory for their participation in on-line professional development. Technical problems in general still inhibit smooth working in on-line courses.
- Many teachers and teacher trainers are novices in using Telematics for learning. Basic skill training seems compulsory here.
- Teachers as well as students lack necessary teaching and learning skills for working in on-line environments. In particular, communication skills relating to on-line moderating or tutoring skills have been identified. Students should also be trained how to learn and communicate in on-line environments. Communication is the core element of on-line learning.

The T3 project has provided expertise regarding the feasibility of implementation strategies for international on-line courses. The project has provided first examples of on-line teacher training across Europe. A variety of strategies have been trialled and the T3 partners have learnt which approaches fit best within certain contexts and circumstances. A generic lesson has been drawn: that human networks are critical for the creation and sustainability of virtual communities. On-line activities should be complemented with face-to-face contacts in some way or another. Within the T3 project, partners have experimented with human networks by creating national or local groups where individuals can meet and discuss off-line. Related to this, the T3 project has also again shown that small and medium-scale initiatives seem to be effective.

The T3 project has provided many insights into the pedagogy of tele-learning and tele-teaching. A major issue here is that teachers as well as learners need to develop new skills in order to function well within telematic learning environments. These skills are closely related to constructivism and the openness and flexibility of learning environments (see Pulkkinen & Ruotsalainen, 1998). In such environments, non-linear learning skills and self-directed learning skills are crucial. The on-line experiences of the T3 partners have taught us that European countries differ in their philosophy of education. As a consequence, learners and teachers have different skills and expectations of how a learning process and teaching tasks look like. On-line learning initiatives across Europe should take advantage of these T3 experiences and take into account the principle that on-line materials and learning modules should avoid extreme approaches to the learning process.

3.4 Socio-economic impact

The T3 project has proven itself to be an innovative project for the educational sector. It is an example of an EU project in which it became apparent that successes are related to national policies. In countries where national initiatives have been taken to stimulate the use of ICT in education, senior managers can be supported to facilitate institutional development and national projects can complement the European activities, providing synergy.

The overarching essential feature of T3 products is the way in which they have been used for both continued delivery on the same site and to expedite the production and delivery of new forms of teacher training though telematic networks. The T3 Evaluation Report (D3.3, chapter 4), the T3 Exploitation Plan (D16.1) and this Final Report describe a pattern that repeatedly occurred, where a teacher or teacher trainer has re-used approaches and material from one or more courses to create a new course specifically for his or her own contexts and students. Frequently, this re-use of T3 products has required significant tailoring, not just in terms of language translation, but also to suit the pedagogical, organisational and technical contexts in which the learning takes place. This is similar to iterative design and evaluation of software by engineers.

This can be clarified with three examples:

- The Utrecht Teacher Training College has decided to integrate the Control Technology course into their curriculum for technology teachers, having first studied it twice with the University of Oulu (the course leaders).
- Jan Rasenberg, who participated as a local tutor with a local group (Rotterdam) in the EuMEDEA Environmental Education course in 1998, is now redesigning the experience into a course for his institution. He plans to use the approach and pedagogy with his own 'content' of teaching materials to cover the required topic within the Rotterdam programme of teacher training.
- Sue Jennings will continue to use and develop the Mathematics WWW site '*Graphics Calculator*' materials and Master Class in and beyond the University of Exeter with her students and teachers. It is also picked up by teachers surfing the Internet and is the focus of a scenario within a book for teachers auditing their ICT knowledge (Trend et al, 1999). During the development of these telematic approaches, she collaborated with Richard Dunne who also deployed them within the University of Portsmouth teacher training courses and schools in Birmingham. Sue has also taken the work on adapting it within a 'courselet' for use by other UK universities, in association with the University of Reading. This course has now been integrated into the ITT teaching programme at Reading University. It will be further adapted for the UK Lottery-funded ICT training for teachers during 1999.

In addition, swift changes are occurring in the national standards required for teacher training. For example, in the UK in the academic year of 1998-99, the Department for Education and Employment (DfEE) issued a new regulation in the form of a *National Curriculum for initial teacher training in Information and Communication Technologies in subject teaching* (DfEE, 1998). This increased and specified in detail new requirements (standards) for teacher training courses applicable for state schools. This is discussed in detail in D15.2-2 where curricula are compared and contrasted. The T3 Exploitation Plan noted that the imposition of detailed specific national or regional standards will contribute to market segmentation.

The delivery of courses also changes with the resources and their infrastructure. For example, sites providing resources on the WWW and the software used to access them develop in short timescales. There is also the very significant issue of scaling up training services, which implies careful attention to training trainers and the systems for accreditation and quality control, including organisational development which moves ICT further to the core of the teacher training organisation. Such changes are already occurring in several of the T3 partner teacher training universities, as predicted by the MIT'90s project. In common with commercial organisations, these changes will also need to be balanced with the sensitive management of people and change and attention to globalisation (Dauphinais & Price, 1998).

Professional and organisational development for distance learning depends on a complex set of changes. The holistic principles of the T3 Core Curriculum (D15.2) can inform the management of change across other sectors, just as they inform the development of local teacher training curricula (see Figure 6). The higher-level issues relating to culture, globalisation and management of change will continually need to be addressed. Lower levels will require specific attention to Networking and Collaboration, Pedagogical Considerations and Technological Considerations. These include:

- updating materials to reflect cultural and curriculum standards
- training trainers to collaborate successfully
- updating equipment for development and delivery of courses
- ensuring equality of access to public education and training.

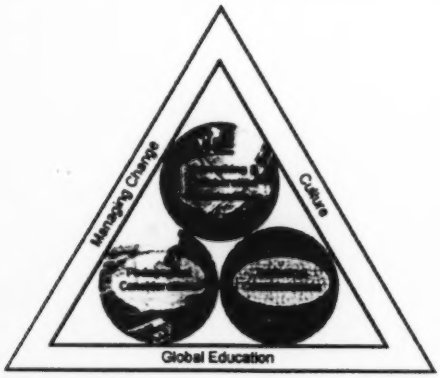

Figure 6: T3 Developed Holistic Principles in a Core Curriculum of Telematics For Teacher Training.

This need to update and replace products and services has been recognised by the T3 project and has been engineered into the services and products. The most important part of the approach has been to encourage and support students and staff (users) to contribute to both the process and the products. For example, peer tutoring and other 'constructive' pedagogical approaches contributing to the teaching process can also contribute to the materials produced by students for examination. These selected materials describe good practice in many curricula areas for other students. This approach may be seen within Oulu's ProTo environment (see Pulkkinen & Ruotsalainen, 1998) and Exeter's Virtual Study Centre (VSC). Figure 7 shows the VSC environment. In the library, students can find assignments written by their peers. In the classroom, the peer tutoring is facilitated by groupwork around a 'table' where they share a pedagogical focus:

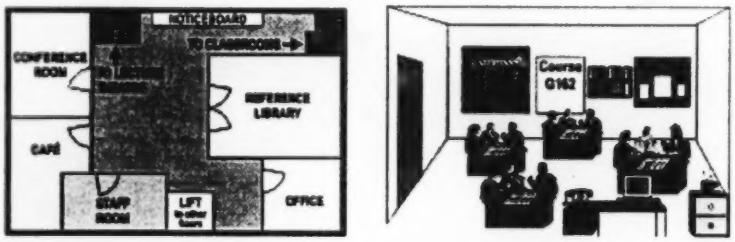

Figure 7: (left) The VSC floor plan used as a menu and metaphor. (right) A classroom based on the room used in the G162 Continuing Professional Development course, to prompt appropriate classroom behaviour.

3.5 Telematics applications

Within the T3 project, teacher trainers found that it was essential to create new resources to demonstrate good practice and to build upon it. In some senses, this has been the development and adaptation of telematics applications to suit the needs of discipline-specific pedagogy and new approaches to teaching and learning (see Wijgh, 1997). The need for a project WWW site, the T3Centrum, support and guidance in the use of Telematics over the WWW and point-to-point video conferencing have all been foreseen. These were successful, as seen earlier in Figure 4 which represents the wealth of on-line resources and activity. These include project guidance and manuals.

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What was not foreseen was the extensive planning and design that were required in order to set up good practice in teacher training for specific subject disciplines, phases, cultures and pedagogy. Some institutions also added language translation. All successful institutions also managed changes in order to incorporate Telematics through professional and organisational development (see Godinet, 1998). Almost all teacher trainers felt obliged to create new resources, although later on trainers were able to adopt earlier resources.

3.6 Dissemination activities

Most of the T3 project activities contributed in one way or another to dissemination. For example, the *'Telematics Times for Teachers'* newsletter was designed to work with the projects' WWW sites, brochures, conference presentations, published papers, exhibitions and demonstrations. Figure 8 provides the final version of the T3 project's home page on the Internet. The layout clearly illustrates the final dissemination approach without blocking off prior routes that users had located. The newsletter is located in the section 'T3 publications and deliverables' (see also D2.2 *Report on newsletters*). It is also valuable to briefly mention the final version of the T3Centrum map, Figure 4, because it provides a graphical representation of the wide range of materials and courses that remain on offer to assist teachers and librarians working to respond to the information society.

In addition to the activities noted in previous sections, the T3 partners have successfully disseminated the work of T3 through active participation in relevant conferences, exhibitions and workshops. This has allowed T3 know-how to become integrated into the wider teacher education community, to inform and enhance the work of other projects, and to influence development of strategic policy.

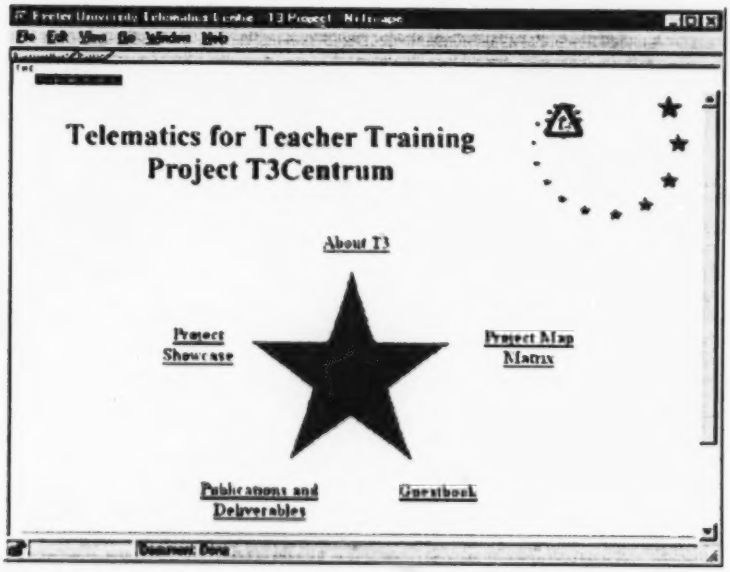

Figure 8: T3Centrum home page on the Internet

Publications

Newsletters were produced collaboratively by the three teacher training projects: T3, TRENDS and REM. D2.2-2 describes this successful dissemination approach in some detail. In addition, T3 activities and research have been reported in the Information Society Newsletter (on paper and on-line), the ITTE Association Newsletter and other national and regional publications.

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Over 35 conference presentations and papers were produced over the three years to international and national conferences in over 14 countries. Presentations of the range and variety of T3 were particularly strong at the CAL97 international conference in Exeter and the IFIP world conference, including Teleteaching '98 in Vienna and Budapest. At least five further presentations are planned in 1999, including to the international conference SITE'99 in Texas on the importance of a global dimension within teacher training.
Over 40 papers have been published by the T3 Consortium in a range of international and national journals, many of which are refereed and address the users T3 aimed to support and influence. Of particular note is the multi-media needs analysis published in the European Journal of Teacher Education (Davis et al, 1997), following presentations of it at ATEE and at invited and annual conferences. Similarly, the needs analyses for library staff (Pye, 1996), mathematics teachers and other disciplines have been reported in the corresponding professional journals.

Consultancy

Groups of experts have visited many of the T3 partner institutions. For example, the Telematics Centre at the University of Exeter has hosted consultations and demonstrations for the Malaysian Ministry of Education and the University of Malaya; ALLFORSK, from Trondheim, Norway; The Chinese Ministry of Education and Beijing Normal University; The British Educational Communications and Technology agency; and Australian colleagues from the State of Victoria and Queensland University of Technology.
Partners' expert contributions have included: The Dutch Government Ministry of Education, Digital Cities Project, The Netherlands; the NUFFIC meeting in Amsterdam; The EUN project Consortium meetings and launch in Brussels; The STACCIS project at Moscow State University, and the Moscow Institute of Economics and Statistics.

Conferences, exhibitions and workshops

T3 has hosted conferences and workshops including: CAL97 international conference, Exeter; T3 Core Curriculum Workshop and Colloquium, Universidade do Minho, Portugal, 20-23 May 1998; LISE (The UK Association of Librarians of Institutes and Schools of Education) conference, Utrecht, February 1998.
T3 has used Telematics to provide contributions to conferences, workshops and visits in order to make efficient use of resources and to demonstrate good practice in the process itself. These have included: multi-point video conference to the Australasia meeting of Australia and New Zealand Education and Training Audio Visual Association; presentation on research approaches informed by T3 to national HE research meeting at University of Twente, The Netherlands; conference for librarians and teachers at the University of Minho; and for visitors from Exeter with partners in Oulu, Utrecht, Genoa, Grenoble and Minho and vice versa.
T3 has demonstrated approaches to teacher training with Telematics at several exhibitions including: BITE Conference, Maastricht, 25-27 March 1998; British Educational Teaching Technology (BETT), London, 16-19 January 1999, at a seminar and on ITTE stand; BETT, London, 14-17 January 1998, at a seminar and on ICL stand; STACCIS Demonstration of TAP Products, Moscow, 24 October 1997.
T3 has provided workshops at events for the user group and researchers, including: 6th Concertation Meeting TAP Education and Training and Educational Multi-Media Task Force, Brussels, 19-20 November 1998; EUN Launch Conference, Brussels, 7-9 September 1998; IFIP working group workshops; Teleteaching '98, Vienna and Budapest, 31 August-4 September 1998; East West Consensus Workshop & Exhibition, Moscow, 6-8 October 1997.

Book proposal

One further major resource and dissemination activity is planned by the T3 project team to archive the expertise gained by the partners of the three TAP projects: T3, REM and TRENDS. A synopsis for a book on on-line learning and teaching for teacher training has been drafted with the working title '*Telematic Learning Environments for Teacher Education*'.The editors will be Dr Wim Veen, T3's evaluator, and Professor Niki Davis, the T3 project coordinator. The book will target educational policy makers, teacher trainers, educational ICT experts, teachers and student teachers.

The book will provide a cohesive view of the various issues that are related to the implementation and the uses of ICT for teacher training. This view stems from the wealth of experiences of professionals, pioneering the adoption and implementation of ICT in teacher training. The book will consist of three parts that will crystallise the contribution of the three teacher training projects supported by the Framework IV Telematics Applications Programme:

Pedagogical Issues
This section will contain a contribution addressing the added value of ICT for non-linear, open and flexible learning from a theoretical point of view, a contribution on how to learn and teach effectively with ICT, and an article on the pedagogy of tele-learning and tele-teaching describing various approaches that have been used in the T3 courses.

Implementation Issues
This section will address the various strategies that can be used to deliver online courses across Europe. The TRENDS Project has developed a training model for online in-service training. This model has been trialed cross nationally and lessons learnt from this experience will be presented. The T3 Project has provided various online courses in which different strategies have been used, relying on the development of a community of practice. Two contributions will show these experiences and their value for future initiatives in the field of cross European teacher training. A supplementary contribution will provide a synthesis of the different experiences.

- **Policy Issues**
  This section will describe the outcomes of the T3 Core Curriculum activities, and will give a view on future opportunities of ICT in teacher education. The core curriculum describes in detail the teaching skills for teachers using ICT. As far as the future developments are concerned the challenges and opportunities of a European market for teacher training will be discussed.

A view from T3 Oulu

Colleagues also provided pointers to the future collaboration and the need to continue to support research into Telematics in teacher training:

> "Many useful resources were created during the project. Several of these were adapted to local contexts and translated. Much still needs to be done. The concept of internationally distributed courses for teachers has a few grey areas that should be examined before establishing a large-scale virtual college for teachers. The structure and philosophy of the curriculum in different countries can, for example, prevent teachers from adopting courses produced in other countries. In addition, the language and the cultural background can be obstacles. Educating the educators involves more than delivering the local courses to students learning at a distance."
>
> ***Jyrki Pulkkinen, T3 Oulu***

4 conclusions & future plans

T3 was a project acting to support specific and especially important users of telematics applications for the information society: teacher trainers, teachers and library staff working with teachers. In some senses, the project was itself an exploitation of partners' expertise, because it trained thousands of teachers in eight European countries. In addition, the opportunities provided through the Telematics for Teacher Training project across Europe provided a fertile context for the research and development of organisational change with Telematics in universities, professional development of a range of staff, and repeated prototyping of the technological interfaces to adjust them and the pedagogies involved.

In 1996, telematics research was only just awakening to the value of adding organisational and pedagogic expertise to multidisciplinary research teams. The T3 project has clearly demonstrated the value of including teacher trainers as both users and researchers. The approach it adopted, iterative prototyping, was appropriate because the interrelated and complex networked environments that occur in teacher training are subject to change and ongoing external pressures.

The project has produced significant needs analyses, examples of good practice and designs that are of value to national and European policy and planning. The T3 Core Curriculum of Telematics for Teacher Training provides a valuable set of principles to inform course design and delivery across Europe, as shown in Figure 6. These principles are also relevant to the management of change in educational organisations, including agencies and commercial service providers.

The creation of an exploitation plan for a support action project in the TAP sector for education and training was fraught with challenges, not least the interpretation of the word 'exploitation' within the culture of education. The suggestion of 'commercial exploitation' of education was not acceptable, especially the exploitation of teachers or children. Therefore, it is in the sense of 'educational exploration' to implement more effective teaching and learning that the term 'exploitation' is used by the T3 project.

The project took measures to investigate the emerging market for teacher training courses and related services across Europe and kept a watch on other parts of the world, including Central and Eastern Europe, North America, Australia and China. The result of that market research showed that there is not a true market for teacher training services in Europe, although one is rapidly emerging in a few countries. However, even in the UK, the most advanced country in this respect, significant intervention by the Government has been undertaken to stimulate the market and to encourage new types of teacher training within and beyond the traditional providers in higher education. This detailed analysis of the market for teacher training is provided in T3's Exploitation Plan (D16.1).

Traditional provision of pre-service and in-service teacher training continues to be offered though universities, colleges and government-funded training centres. For this reason, major exploitation of the T3 project is achieved through the partner institutions and every institution has integrated Telematics into its provision. Fifteen additional courses and 19 sets of resources covering a range of subject disciplines and users are now available from partner institutions. These institutions and their collaborators will continue to provide 'reference sites' to spread good practice. Evidence of significant challenges is provided in relation to exploitation of courses across cultures and languages, and this difficulty of transfer is in inverse proportion to the age of the children taught. The younger the children in Europe, the less likely their teachers are to be able to work in another language and the less likely that

they share a common pedagogy or curriculum. Differences are most extreme for educators of nursery children (3-6 years old).

T3's reports include evidence that courses and resources will continue to be exploited, at least regionally. Five further routes are planned:

1. Through national initiatives that recycle T3 expertise to match government aims, for example, UK Lottery-funded ICT teacher training, Finland's continuing programme of updating schools and The Netherlands' re-engineering of education.
2. Wider publication of the project's findings, for example, publications in journals and newsletters will be developed into a book to be published in late 1999.
3. T3 has made a significant contribution to the design of educational WWW sites in the T3Centrum and T3 Showcase. Periodic redesign of T3's inter-linked WWW sites and their diffusion encourage further dissemination, for example, by relocation of relevant sections into other sites such as EUN and those of professional associations.
4. Potential expertise for the creation of new courses for European teacher training using the knowledge gained from the T3 project and the excellent working relationships that have been developed by core partners.
5. Use of T3's findings to inform Framework V research into the appropriate pedagogical, technological and organisational development required to validate the concept of a teacher training college in a virtual university. Such a college would aim to provide high-quality training for pan-European teachers of the next century, including preparation to manage change.

In conclusion, the teacher training and organisational change provided by the T3 project has offered and will continue to offer Telematics in teacher training, good practice and significant resources. These will enable teachers and teacher trainers to participate more fully in the information society, and are also made available to inform new initiatives and projects.

> "The first and most important achievement is the creation of an international team of researchers that are now in a position to carry out complex projects and research in the field of educational technology.
>
> Regarding content, another achievement was the reflection on transferability of content, imposed by the effort of 'internationalising' our courses. We must admit that not all of the T3 courses were easily transferable across Europe, and this is due not only to differences in approaches but also to the choice of content.... when choosing content we should ask ourselves: "Why should the students make the effort to overcome the numerous barriers, especially the language barrier, to study this content in a virtual, international community?
>
> Now that we have a real transnational team, joint development of courses should be easier than it was three years ago and tackling the problems of transferability (cultural differences, differences in the educational systems and language problems) from the outset should guarantee an even higher degree of success."

Donatella Persico, T3 Genoa

5 Contact details

Project Name: T3: Telematics for Teacher Training

Research Area: Education and Training for teachers, teacher trainers and education librarians.

Timescale: 01.01.96 - 31.12.98

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Key Project Participants:

Project Partners	Contact	Contact Details
C1 University of Exeter (UK)	Professor Niki Davis Telematics@exeter.ac.uk +44 1392 264758	University of Exeter School of Education Heavitree Road Exeter EX1 2LU **UK**
C2 IUFM Grenoble (F)	Professor Bernard Cornu Bernard.Cornu@grenoble.iufm/fr +33 10 64 757319	IUFM de Grenoble 30 Av. Marcelin Berthelot 38100 GRENOBLE **France**
C3 University of Oulu (FI)	Jyrki Pulkinnen Jpulkkin@ktk.oulu.fi +358 8 553 3603	University of Oulu Faculty of Education Linnanmaa PO Box 222 90571 Oulu **Finland**
C4 University of Utrecht (NL)	Dr Wim Veen w.veen@ivlos.uu.nl +31 30 253 2342	University of Utrecht IVLOS – Institute of Education Heidelberglaan 8 CS 3584 Utrecht **The Netherlands**
C5 University of Minho (PT)	Dr Jorge Bentes bentes@ci.UMINHO.pt +351 53 510259	Departmento de Informatica, Universidade do Minho Campus de Azurem 4800 Guimaraes **Portugal**
C6 Dublin City University (EI)	Peter McKenna peterMcK@iol.IE +353 1 704 5221	Dublin City University Dublin 9 **Ireland**
C7 ICL (UK)	Dick Hill dick.hill@iclnet.co.uk +44 1924 812113	ICL plc, Computer House 127 Hagley Road Birmingham B16 8LD **UK**
C8 ITD, Genoa (IT)	Dr Donatella Persico persico@itd.ge.cnr.it +39 10 647 5313	Istituto Tecnologie Didattiche - CNR Via de Marini, 6 16149 Genoa **Italy**
C9 University of Gent (BE)	Professor Ronald Soetaert Ronald.Soetaert@rug.ac.be +32 92 643563	Royal University of Gent 5 Sint-Pietersplein B9000 Gent **Belgium**

Project Coordinator:

Professor Niki Davis
Tel: +44 1392 264758
Fax: +44 1392 493761
E-mail: telematics@exeter.ac.uk
Project URL: http://telematics.ex.ac.uk/T3

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PROJECT CONSORTIUM

University of Exeter (UK) (Lead) IUFM Grenoble (F) University of Oulu (FI) University of Utrecht (NL) University of Minho (PT)	Dublin City University (EI) ICL (UK) Istitutio Technologie Didattiche, Genoa (IT) University of Gent (BE)

Contact Address:

Professor Niki Davis Telematics Centre University of Exeter School of Education Heavitree Road EXETER EX1 2LU UK	Telephone: +44 1392 264758 Fax: +44 1392 493761 E-mail: t3@exeter.ac.uk WWW: http://telematics.ex.ac.uk/T3/

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Further information on the TELEMATICS APPLICATIONS Programme:

You can obtain more information on the projects of the TELEMATICS APPLICATIONS Programme from:

European Commission, DGXIII, C/1
TELEMATICS APPLICATIONS Programme Information Desk
Rue de la Loi 200 – BU 29 04/05
B-1049 Brussels

Fax: +32 2 295 23 54

E-mail: telematics@dg13.cec.be

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"The relevance of T3's Final Report is that it provides a description of the wide-ranging and innovative research and development of teacher training across Europe. The report is a way of providing material and forums to help teachers understand the new ways and some best practices."

Dick Hill, ICL UK

"Not only did T3 meet identified objectives but it established a working model for continued development of courses, materials and training within the participant countries and beyond.

It is quite incredible that this number of very different countries with different cultures and languages could come together and work cooperatively toward common goals. The pattern of success of the cooperation as well as the quality of the training produced and the continuing positive effects of that training are inestimable not only for Europe but as a model for the world to imitate."

Dee Anna Willis, North West State University, USA
Vice President of the Society of Information Technology in Teacher Education

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Price £5.00 (payment with order)

The Telematics Centre
School of Education
Heavitree Road
Exeter UK EX1 2LU

THE TELEMATICS

Director: Professor Niki Davis

Telephone (01392) 264758
Fax (01392) 493761
telematics@exeter.ac.uk
http://www.ex.ac.uk/telema